Hence the period of revolution in 1812 has been shortened by perturbation to the extent of 445·49 days. The orbital velocity of the comet at perihelion is 29·2 miles in a second, at aphelion it is 3550 feet in the same time.

THE GLASGOW CATALOGUE OF STARS.—Prof. Grant has just issued the important catalogue of stars which has been for some time in active preparation at the Observatory of Glasgow, and towards the publication of which the Royal Society has largely contributed from the Government Grant Fund. Its appearance is too recent to allow of a description of the contents in the present column.

THE VARIABLE STAR U GEMINORUM.—Mr. G. Knott, writing from Cuckfield on the 4th inst., sends observations of a recent maximum of this star; his estimates are:—

	h. m.				h. m.		
Jan.	24, 8 10	...	13·3 m.	Jan. 28, 8 15	...	9·95 m.
	26, 9 50	...	9·6	30, 9 0	...	11·4
	27, 8 53	...	9·7	Feb. 2, 7 20	...	13·9

Clouds prevented observation on January 25, but it is quite possible that the maximum may have been attained on that day, since in 1877 the star increased from 13·2 m. to 9·8 m. between February 20, 8h. 10m., and February 21, 10h. 30m. The last previous maximum observed by Mr. Knott fell on January 30, 1883, the date also assigned by the observations of M. Safarik (*Astron. Nach.* No. 2505).

The period which best represented the observations in the years immediately following the discovery of the star's variability by Mr. Hind (in December 1855) was 97 days, but there has been subsequently great irregularity, and according to Mr. Knott it has fluctuated between 71 and 126 days, though the values on the whole cluster about a mean of from 90 to 100 days; the limits of variation being about 14½ and 9½ of Argelander's scale. These inferences are drawn from thirty-four maxima, observed partly by Mr. Knott and partly by Mr. Baxendell (see the *Observatory*, April, 1882).

THE LATE J. F. JULIUS SCHMIDT.—Practical astronomy has sustained a serious loss in the sudden death of the well-known Prof Julius Schmidt, who has been for many years Director of the Observatory at Athens. According to a Reuter's telegram his funeral, which took place on the 8th inst., was of a public character, the King and Queen of Greece being present at the Observatory during the delivery of the funeral oration. A notice of Prof. Schmidt's long-continued astronomical labours must be deferred to another week.

THE ROYAL SOCIETY OF EDINBURGH

AT the meeting of this Society on the 4th inst., the President, Lord Moncreiff, delivered an address on "The Past Hundred Years' History of the Society." Regarding this long interval, Lord Moncreiff said: "From the watch-tower of the Royal Society I can trace within the century a revolution more wonderful and more extensive than monarchs, or empires, or republics can display. Since this Society held its first meeting, how great to the community has been the fruit gathered from those branches of knowledge which it was incorporated to prosecute! During that interval, what has science not done for human comfort and happiness? What interest so great, what dwelling so humble, as not to have felt its beneficent influence? Since the invention of the art of printing, no such advance in material comfort, prosperity, and intelligence has ever been made within a similar period as this century has witnessed. Its triumphs have not been confined to the more abstruse fields of thought and study, but have come straight to the world of every-day life. One homely illustration meets me on the threshold of the opening night, and homely things go deep into the foundations of human life. I picture to myself our founders wending their way to the College Library, through close and wynd, in mid-winter 1783, while flickering oil lamps made the darkness visible without, and a detestable tallow candle made the student miserable within doors. Those who cannot recollect the universal reign of tallow candles and their sufferers, cannot appreciate how much the sum of human enjoyment has been enhanced, and the tranquillity of human temper increased, by the transmutation—partial, we must admit—of darkness into light. There has been, I believe, no more potent agent in humanising the denizens of our large cities than the flood of light which chemical science has in our day poured into their recesses. Prophets tell us that, before the end of the century which we now begin, gaslight will probably have followed the tallow candle into the same unlamented obscurity; but, even should this be so, history will carry to its credit the vast amount of public utility, and the many hours of useful employment or comfort in the factory, the study, or the sick-room, which this simple application of chemical science gained in its day for the nineteenth century. But the dispersion of material darkness is but a slender illustration of the triumphs of scientific discovery. Time and space are no longer the tyrants they were in 1783. I rather think that when our founders first met they could hardly hope to hear by post from London under ten days, as Palmer's mail-coaches had not begun to run until 1789. It would be an interesting inquiry, if my limits permitted, to trace the moral and social effects of the change from the days when a London letter took even three days to reach Edinburgh, and cost 13½d.—the pre-Macadamite days, when twenty miles a day was a fair posting rate on any roads but the main thoroughfares. Lord Cockburn lamented over the prospect of London being within fifteen hours of Edinburgh, as endangering the characteristics of our social community. His sagacity was not altogether at fault, but even that time has been reduced by a third, and I rather think we and the world are all the better for the change. But although larger victories were in store for the century, they came slowly. Both Boulton and James Watt were original members of the Royal Society, but it was more than thirty years before steam navigation became general, and more than fifty before the first passenger railway train ran in Scotland. No doubt, in 1791, Erasmus Darwin, in his 'Botanic Garden,' a poem too little read, had exclaimed in the well-known lines:—

'Soon shall thy arm, unconquered steam, afar,
Drag the slow barge, and urge the flying car.'

Godwin, too, looked forward with confidence to the ultimate victories of steam. Now, the locomotive carries mankind to all ends of the earth; their sanguine suggestions have been all but realised. There has been during this interval a still more powerful magician at work. To this audience I need not dwell on the triumphs of the future ruler of the world of science—electricity. But one illustration I may be permitted. Franklin was one of the first of the non-resident members elected by the Royal Society of Edinburgh. How little he thought when, many years before, he drew the electric spark from the cloud, that, before 100 years had sped, his experiment, but slightly modified, might convey a message from a meeting of the Society in Edinburgh to one of its fellows in New York, and bring back an answer before the meeting separated. In slightly alluding to this scientific revolution, my object has been partly to illustrate the surroundings of 1783, and also to remind my hearers that, of all the changes the century has seen, far the most important and the deepest have been the work of science. Increased facilities for inter-communication carry with them a complete change in the economical and social condition of the communities they affect. New wants, new customs, new ambitions, new possibilities, follow in their train by the operation of inevitable laws. By this talisman we have seen, perhaps sometimes without due appreciation, many a social problem solved which had before seemed hopeless; and although in the process of transition some period of adaptation may be necessary, and some temporary hardships endured, the result in all cases must be beneficent, and is, at all events, beyond the power of lawgivers to control or to resist.

"The Edinburgh Royal Society sprung partly out of the example of the Royal Society of London. But its immediate antecedent was the Philosophical Society, which had been founded nearly fifty years before by the celebrated McLaurin, and contained many distinguished names. Lord Kames became its president, and raised it to considerable distinction, both in science and literature, although that vigorous and versatile thinker and writer did not live to witness the commencement of the new institution. Dr. Robertson's plan was to absorb this Society and all its members in a new institute, on the model of the Berlin Academy of Sciences, for the prosecution both of physical science and of literature. The charter, however, was not obtained without some controversy, for, even as Romulus and Remus quarrelled over the boundaries of unbuilt Rome, so did the Philosophical and the Antiquaries squabble over the charter of the Royal Society. The Antiquaries wanted a charter of their own; Dr. Robertson thought Scotland not wide enough for two such institutions; the feud ran high, and great was the "dust," as Prof. Dalzel calls it, which was raised by Lord Buchan on the occasion. Some notice of this dispute will be

found from the Antiquaries' side of the question in the recent life of Henry Erskine; and it is also alluded to in Mr. Cosmo Innes' work, where a letter is quoted from the energetic Professor of Greek couched in terms more forcible than philosophical. But it is certainly time to bury such feuds when they come to be a hundred years old. I find, from the minutes of the first meeting, that the Society was of opinion that the College Library was an inconvenient place for their usual meetings, and a committee was appointed to find one more suitable, apparently without success, for they continued to be held in the Library for twenty-three years, when the Society migrated to the Physicians' Hall in George Street in 1807. They afterwards purchased No. 40, George Street, in which the meetings were held until they obtained their present rooms in the Royal Institution. At a subsequent meeting, held on August 4, 1783, it was resolved that the Society should divide into two classes, which should meet and deliberate separately, to be called the Physical Class and the Literary Class, with separate office-bearers.

"The first president was Henry, Duke of Buccleuch, who had rendered great assistance in obtaining the charter. The vice-presidents were the Right Hon. Henry Dundas and Sir Thomas Miller, the Lord Justice Clerk. I forbear to go over the names of what may be called the original members of the Society. I include in that term all who were elected within the first ten years. All the members of the Philosophical were assumed without ballot; the rest, to the number of more than 100, were elected by ballot, and a general invitation was made to the Lords of Session to join. These were the ordinary resident members. There was also a list of non-resident members, which comprised nearly as many. Of the ordinary resident members there is hardly a name which is not known—I might say conspicuous—in the annals of Scotland at that time. Twelve of the Lords of Session accepted the invitation, including the Lord President, the Lord Justice Clerk, and the Lord Chief Baron of the day; upwards of twenty professors, with Principal Robertson at their head; twenty-two members of the bar, including Sir Hay Campbell, the Lord Advocate, and of these at least fourteen rose afterwards to the bench. The medical contingent included Munro, Cullen, Gregory, and Home; and the non-resident list contained the names of the Duke of Buccleuch, the Earl of Morton, the Earl of Bute, the Earl of Selkirk, Lord Daer, James Steuart Mackenzie, the Lord Privy Seal, Sir George Clerk Maxwell of Penicuik, Sir James Hall of Dunglass, and many other familiar names. But I select from the list those of the members on whom fell the burden of the real work; and I venture to say that no city in Europe could have brought together a more distinguished circle. They were—Hay Cambell, Henry Dundas, Joseph Black, James Hutton, John Playfair, Adam Smith, William Robertson, Dugald Stewart, Adam Ferguson, Alexander Monro (*secundus*), James Gregory, Henry Mackenzie, Allan Maconochie, and William Miller of Glenlee. I ought to add to these Sir James Hall of Dunglass, and Sir George Clerk Maxwell of Penicuik, the last of whom died the first year. Some of these names are European; all are celebrated; and these were men who, for the most part, did not merely contribute the lustre of their names to the infant Association, but lent the practical vigour of their great intellectual power to aid in the first steps of its progress. And very soon the impress thus stamped on the Society began to establish its reputation in the world, and it took no undistinguished place among the learned societies of Europe. I find the names of Goethe and Buffon among the original foreign members; and although the events of the next twenty years interrupted our relations with the Continent, by the time the Society had completed the half-century there was scarcely a distinguished *savant* in Europe who had not joined, or been invited into, our ranks.

"In the Physical Class were four men who rose to great positions in the scientific world, and to whom the Society was greatly indebted for their general reputation, and for the vigour and efficiency with which their proceedings commenced. They were James Hutton, Joseph Black, John Playfair, and Dugald Stewart. Hutton and Black were then in the zenith of their fame, and have left a strong impress on the first years of our Society. I am desirous, in this review of the Society's early days, to revert with gratitude and respect to the memory of one whose labours on behalf of the Society were invaluable. Hutton was an observer and a thinker of remarkable originality and power. Black, again, was a Frenchman by birth, although his parents were British, and he was nearly related both to Adam Smith and to Adam Ferguson. He came to Scotland when he was about twelve years old, and, long before the institution of the Royal Society, had risen to the front rank of European chemists—his discoveries on pneumatic chemistry and latent heat having laid the foundation of much that is valuable in subsequent investigations, and opened a course of inquiry pursued with great ability in our own *Transactions* by Leslie, and Brewster, and Forbes." Lord Moncreiff having glanced at some peculiarities of the social meetings of those days between Black, Adam Smith, Hutton, and others, proceeded to speak of Playfair and Dugald Stewart, who by themselves could have raised to distinction any circle to which they belonged. "Both of them were men of great versatility, and, within the walls of the Royal Society, capable of filling a foremost place whether in the fields of abstract science or in those of literature or mental philosophy. Dugald Stewart's contributions to the *Transactions* are not so numerous as those of Playfair; but no man had more influence in moulding the tone and cast of thought prevalent among the cultivated class of his countrymen than that most popular and most eloquent instructor of youth. But no one can study these volumes of the *Transactions*, as I have done, without feeling that, for the first two decades of the existence of the Royal Society, Playfair was the soul and life of the institution. His versatility and power have impressed me exceedingly, high as was the estimate I had previously formed of him. Profound and transparently clear, whatever might be the topic, he bears about with him a far-reaching vigour which never flags. Whether it be the origin and investigation of porisms, or the astronomy of the Brahmins, or their trigonometrical calculations, or meteorological tables, or a double rainbow, nothing seems too great or too small for him.

"There are many curious and interesting by-paths, both of science and of literature, traversed in these earlier volumes. In 1787 Mr. George Wallace read a paper, which he did not incline to have printed in the *Transactions*, which I regret, for it related to a subject the interest of which has not ceased by the lapse of nearly a century. Its title was, 'On the Causes of the Disagreeableness and Coldness of the East Wind.' In the first volume of the *Transactions* a very singular problem was presented to the Society, through Mr. Adam Smith, along with other learned bodies in Europe, by a Hungarian nobleman, Count Windischgratz, and a prize was offered by him of 1000 ducats for the best solution of it, and 500 ducats for an approximation to a solution. It was a bold effort of philanthropy, for its object was the abolition of lawyers for the future. The problem was addressed to the learned of all nations. It was couched in Latin, but was in substance this:—'To find formulæ by which any person might bind himself, or transfer any property to another, from any motive, or under any conditions, the formulæ to be such as should fit every possible case, and be as free from doubt and as little liable to controversy as the terms used in mathematics.' I suppose that the prospect here held out of dispensing for the future with the least popular of the learned professions inclined the Society to entertain it favourably, for they proceeded to invite solutions of the problem, and three were received by them. In 1788 we find it recorded in the minutes that Mr. Commissioner Smith (for so the author of the 'Wealth of Nations' was designated) reported the opinion of the Committee that none of the three dissertations amounted to a solution, or an approximation to a solution, of that problem; but that one of these, with a certain motto, although neither a solution nor an approximation to a solution, was a work of great merit; and Mr. Fraser-Tytler was instructed to inform Count Windischgratz of their opinion. Whether this meritorious dissertation obtained the 500 ducats or not, we are not informed, but as lawyers continue to flourish, and legal terminology to produce disputes as prolifically as ever, it seems clear that the author had not earned them.

"Now that we have an Observatory on Ben Nevis, our successors at the end of the next century will know accurately the conditions of the climate under which the hundred years have been spent. There are, however, some details scattered over these volumes which are sufficiently interesting, although whether they show any material alteration in our seasons may be doubtful. The only cheering fact which they disclose is that the first set of returns is decidedly the most discouraging, and certainly does not support the idea that the mean temperature in the olden time was higher than it is now. There are two sets of returns printed in the first volume of the *Transactions*—one kept at Branxholm from 1773 to 1783, communicated by the Duke of Buccleuch, who was the

first president of the Society; and the second by Mr. Macgowan, kept at Hawkhill, near Edinburgh, from 1770 to 1776. In the first, the mean temperature of the ten years is 44°; in the second, 45°—not a very genial retrospect. Things must have been somewhat discouraging for the farmers in 1782, for a paper is noticed in the second volume of the *Transactions*, by Dr. Roebuck, of Sheffield, who was the manager of the Carron Iron Works, recommending farmers not to cut their corn green in October, although there was ice three-quarters of an inch thick at Borrowstounness, because corn would fill at a temperature of 43°. Things looked brighter from 1794 to 1799, for which years we have results furnished by Playfair. For the first three years—1794, 1795, and 1796—the mean temperature was 48°; and that although 1795 was one of the most severe winters on record, the thermometer having stood frequently several degrees below zero, and a continuous frost having lasted for 53 days. The mean temperature in 1794, however, was 50°. The account of the great frost of 1795, which is given in the *Transactions*, is well worth referring to. In the next three years the mean temperature was 48°, that of 1798 being 49°·28. Of this year (1798) Playfair says that the climate of this part of the island hardly admits of a finer season. No tables were furnished to the Society, in continuation of those of Prof. Playfair, until 1830, when fortunately Dr. Barnes of Carlisle communicated to the Society a series of meteorologica tables kept at Carlisle for the first twenty-four years of the century. The results seem mainly to concur with those of Prof. Playfair—the mean temperature for the twenty-four years being 47°·4547, being 3° higher than the average of the ten years from 1773 to 1783 at Branxholm, and 2° higher than the mean temperature of the seven years from 1770 to 1776 at Hawkhill. The highest temperature I have noted in these returns is that of May 1807, when the thermometer stood at 85° at Carlisle, and the next, that on the 5th of August, 1770, when the thermometer at Hawkbill was at 81°. The two years of the century in which the mean temperature was the highest were 1811 and 1822, in both of which years it was 49°.

"Of the purely scientific part of the Royal Society's work for the first fifteen years of its labours, while Hutton and Black and Playfair and Stewart were in full vigour, it is not too much to say it was brilliant—full of interest, full of power, and full of enthusiasm. The first great founders of course gradually waned, and all such associations are necessarily subjected to alterations of the tide, but as the tale goes on the mathematical papers begin to bear the names of John Leslie and William Wallace. We encounter Walter Scott in 1800, in 1808 the name of David Brewster, and in 1811 that of Sir Thomas Macdougall Brisbane, whose names adorned and whose labours were in the future the prop and stay of the Society. Of Scott I need not speak; but of the services rendered by Brewster it is impossible to express myself too strongly. He, too, like Playfair, had a mind of rare versatility. He could observe, as well as draw from his own resources. He could reason as well as describe. He could build a framework of sound deduction from the most unpromising hypothesis, and work out with unflagging spirit the thread of demonstration, however slender. He was the most prolific contributor of his day; nor do I think that any one but himself in these times could have kept the fire lighted by Hutton and Playfair burning so brilliantly. For it is not to be disguised that in the heat of the Continental struggle an air of languor creeps over the proceedings. The joyous enthusiasm of 1783 refuses to be invoked, and is elicited in vain. Nor is it wonderful. When the Gauls were so nearly at our gates, the safety of our own commonwealth was comparatively our only care. But when 1815 had arrived, and men's minds, set free from the long anxiety, had again tranquillity to cultivate the arts of peace, the energy of the rebound was great, and the history of British science has been one continued triumph ever since. By the exertions of Brewster and Brisbane, and many other associates, our Society again began to flourish, both leading and following the course of discovery as the stream flowed on. Both of these men continued to be the pride and ornament of the Society long after the expiration of the half-century which I have assigned to myself as my limit, for Thomas Brisbane succeeded Sir Walter Scott as president in 1832, and survived until 1860. Long before that a new generation had surrounded the veteran philosophers, and their destiny has been to recount and carry forward discoveries of which even Brewster and Brisbane hardly dreamt.

"Enough for the present of this retrospect, and the slender tribute I have attempted to pay to the memory and labours of a masculine and powerful generation. That we have built on their discoveries and learnt even by their errors is quite true; for the history of the second half of the century exhibits science far in advance of 1783, and even of 1833. In 1783 geology was in its infancy; palæontology was all but unknown. Cuvier was only then commencing his pursuits in comparative anatomy, which were to end in reproducing the forms of extinct life. The Glacial epoch had not then been elucidated by the research and genius of Forbes and Agassiz, and the dynamic theory of heat was still unproclaimed. The wonders of the photographic art were unknown even in 1833, for Talbot and Daguerre did not come on the scene for several years afterwards. In 1833 the apostle and disciples of evolution had not broken ground on that vast field of inquiry. Spectrum analysis and the marvellous results which it has already furnished and those which it promises have in our day only heralded the advent of a new science. But however far in advance of the founders of the Royal Society the current philosopher may be, there was a robustness and characteristic individuality about the great men of that generation which we may not hope to see replaced. We may assume—indeed, we hope—that the close of the next century will find the progress of knowledge as far advanced beyond its present limits as we think that the science of to-day is beyond the point reached a century ago. We may be assured that before that time arrives many surmises, still in the region of hypothesis, will have become certainties, and that many supposed certainties will have turned out fallacies. Many errors will have been corrected, many dogmas discredited, many theories confirmed or refuted, at the bar of ascertained fact, as those of 1783 have been. Yet even then will our successors, I trust, as we do now, stand reverently before the memory of our founders. Happy is the institution which can show such a muster-roll, and happy the country which can boast such sons. I take leave of my theme with the fervent hope and firm conviction that in the century which we now inaugurate the Royal Society will continue with success the noble task to which by its charter it is devoted, of investigating the hidden treasures of nature and appropriating them to the benefit and happiness of mankind."

INSTINCT

1. *Is there a Science of Comparative Psychology?*

"IN the family of the sciences Comparative Psychology may claim nearest kinship with Comparative Anatomy; for just as the latter aims at a scientific comparison of the bodily structures of organisms, so the former aims at a similar comparison of their mental structures." These words form the opening sentence of Mr. G. J. Romanes' Introduction to his recently published volume on "Mental Evolution in Animals," and in a footnote he is careful to remind us that the phrase "mental structures" is used in a metaphorical sense. Let us consider how far a comparison of the mental structures of animals, even in a metaphorical sense, is possible.

Our knowledge of mind is either direct or inferential: direct on the part of each individual so far as his own individual mind is concerned; inferential so far as the minds of others are concerned. For it is a law of our being that mind cannot come into direct contact with mind. This fact—that the mental processes of our neighbours can never come within the sphere of our objective knowledge—has long been recognised (see *ex. gra.* Berkeley, "Princ. Hum. Know.," §§ 27 and 145; Kant as quoted in F. Pollock's "Spinoza," p. 177); and the late Prof. Clifford (see "Lectures and Essays," vol. ii. p. 72) coined the exceedingly convenient term *ejective* as descriptive of that class of phenomena which belong neither to the subjective nor to the objective category. My neighbour's mind is not and never can be an object; it is an eject, an image of my own mind thrown out from myself. Into every human being that I meet I breathe this subtle breath; and that man becomes for me a living soul.

Our knowledge of mind is therefore partly subjective, partly ejective. Now it is perfectly obvious that, were I an isolated unit, shut off from all communication with my fellows, no science of psychology would be possible for me. I might by the analysis of my own mental processes arrive at certain conclusions with regard to my own states of consciousness; I might reach some sort of knowledge of the working of my own mind. But this would not be a science of mind. A science of mind only becomes possible when I am able to compare my own conclusions with those which my neighbours have reached in a similar manner. By means of language human beings can communicate to each